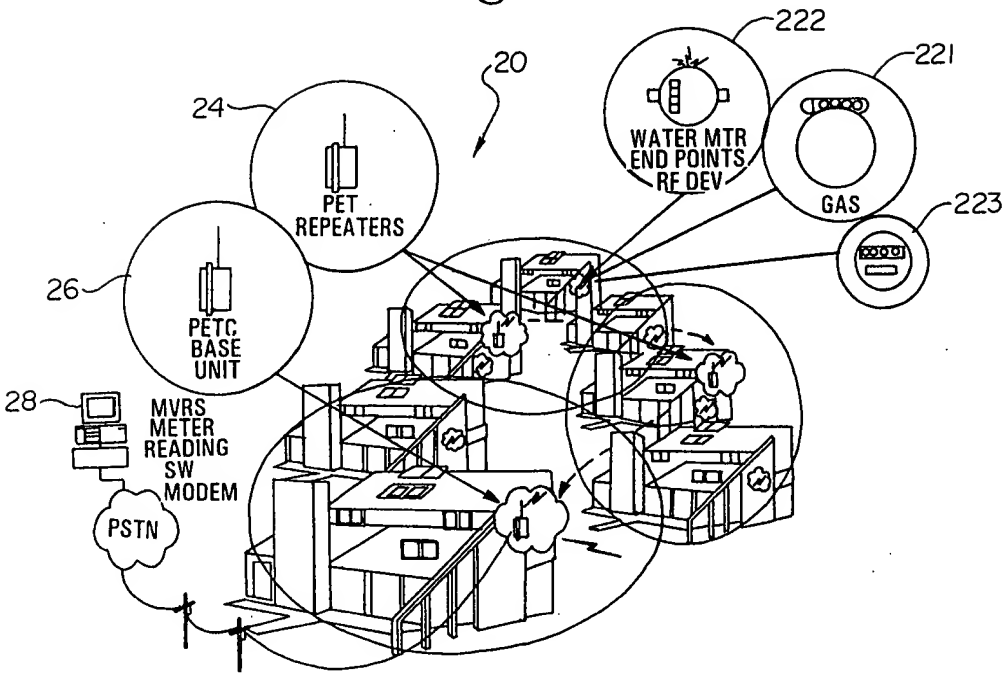
OIPE IAP74
AUG 17 2007
PATENT & TRADEMARK OFFICE

Fig. 1



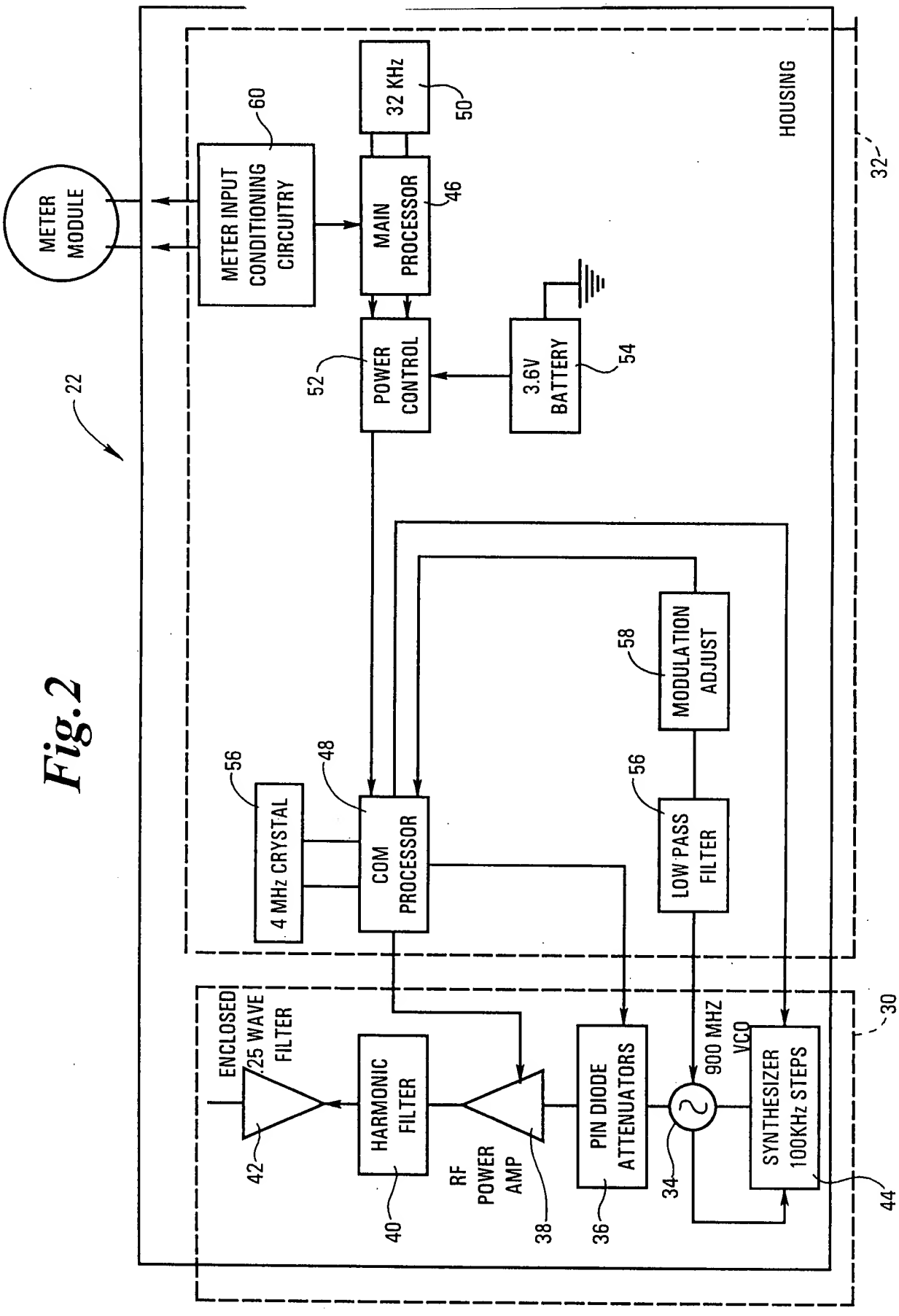
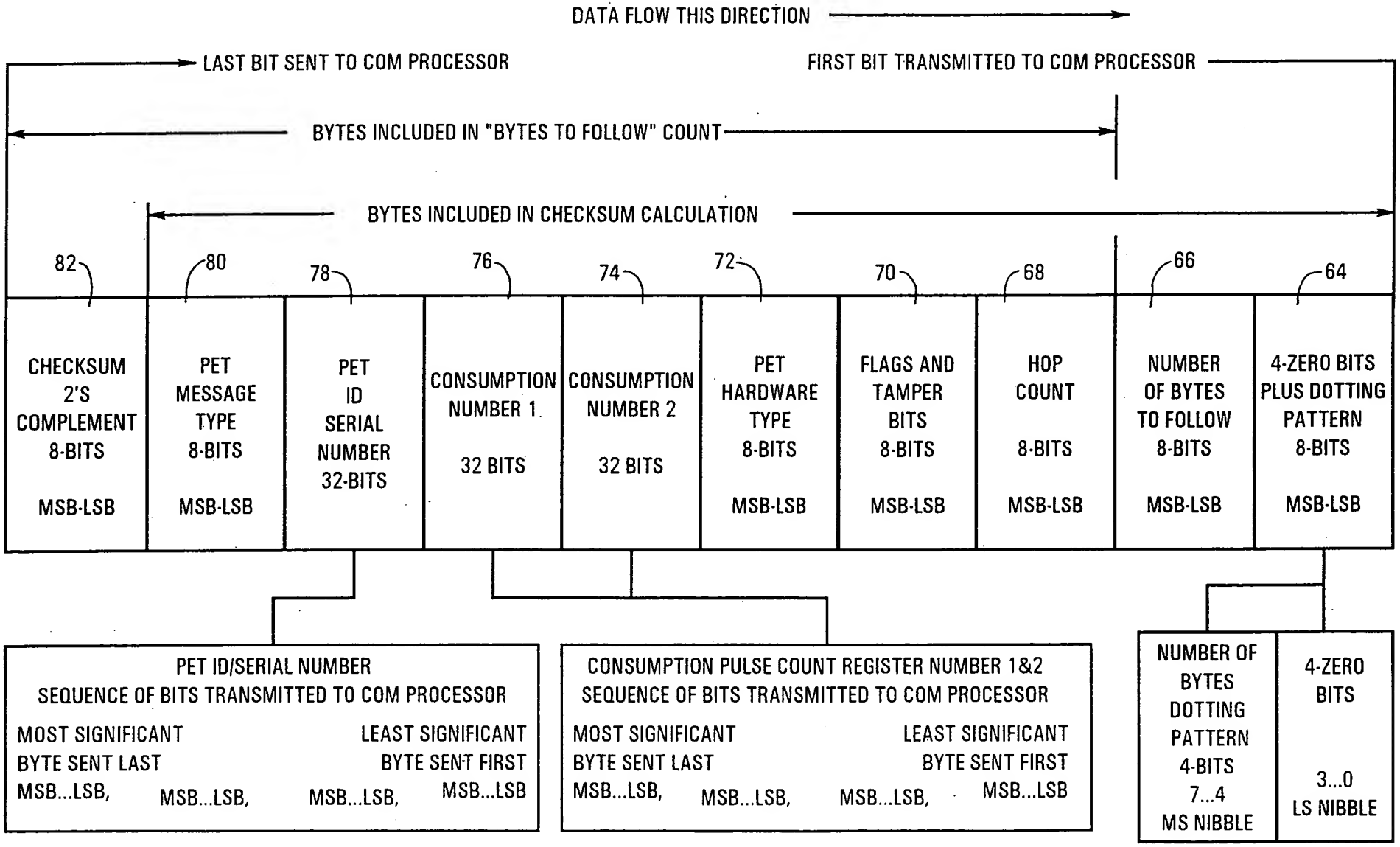

METER MODULE
METER INPUT CONDITIONING CIRCUITRY
60
32 KHz
50
MAIN PROCESSOR
46
HOUSING
32
POWER CONTROL
52
3.6V BATTERY
54
22
MODULATION ADJUST
58
56
4 MHz CRYSTAL
48
COM PROCESSOR
56
LOW PASS FILTER
ENCLOSED
25 WAVE FILTER
HARMONIC FILTER
RF POWER AMP
PIN DIODE ATTENUATORS
900 MHZ VCO
SYNTHESIZER 100KHz STEPS
30
42
40
38
36
34
44

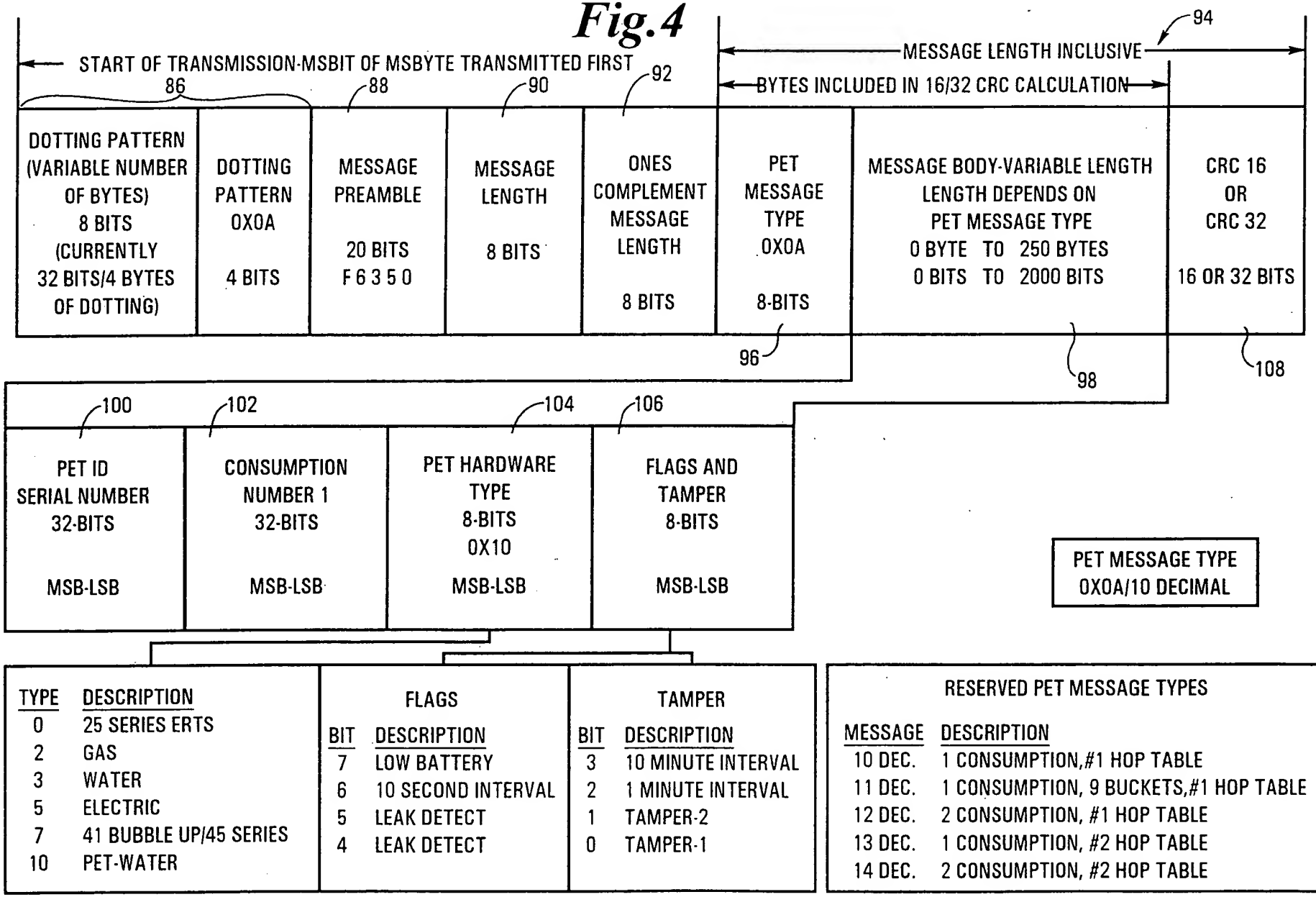
Fig. 2

Fig.3



Application No. 09/911,840
Amendment Dated August 14, 2007
Reply to Office Action of June 27, 2007
Replacement Sheet

Fig.4



TYPE	DESCRIPTION
0	25 SERIES ERTS
2	GAS
3	WATER
5	ELECTRIC
7	41 BUBBLE UP/45 SERIES
10	PET-WATER

FLAGS

BIT	DESCRIPTION
7	LOW BATTERY
6	10 SECOND INTERVAL
5	LEAK DETECT
4	LEAK DETECT

TAMPER

BIT	DESCRIPTION
3	10 MINUTE INTERVAL
2	1 MINUTE INTERVAL
1	TAMPER-2
0	TAMPER-1

RESERVED PET MESSAGE TYPES

MESSAGE	DESCRIPTION
10 DEC.	1 CONSUMPTION,#1 HOP TABLE
11 DEC.	1 CONSUMPTION, 9 BUCKETS,#1 HOP TABLE
12 DEC.	2 CONSUMPTION, #1 HOP TABLE
13 DEC.	1 CONSUMPTION, #2 HOP TABLE
14 DEC.	2 CONSUMPTION, #2 HOP TABLE

Fig.5

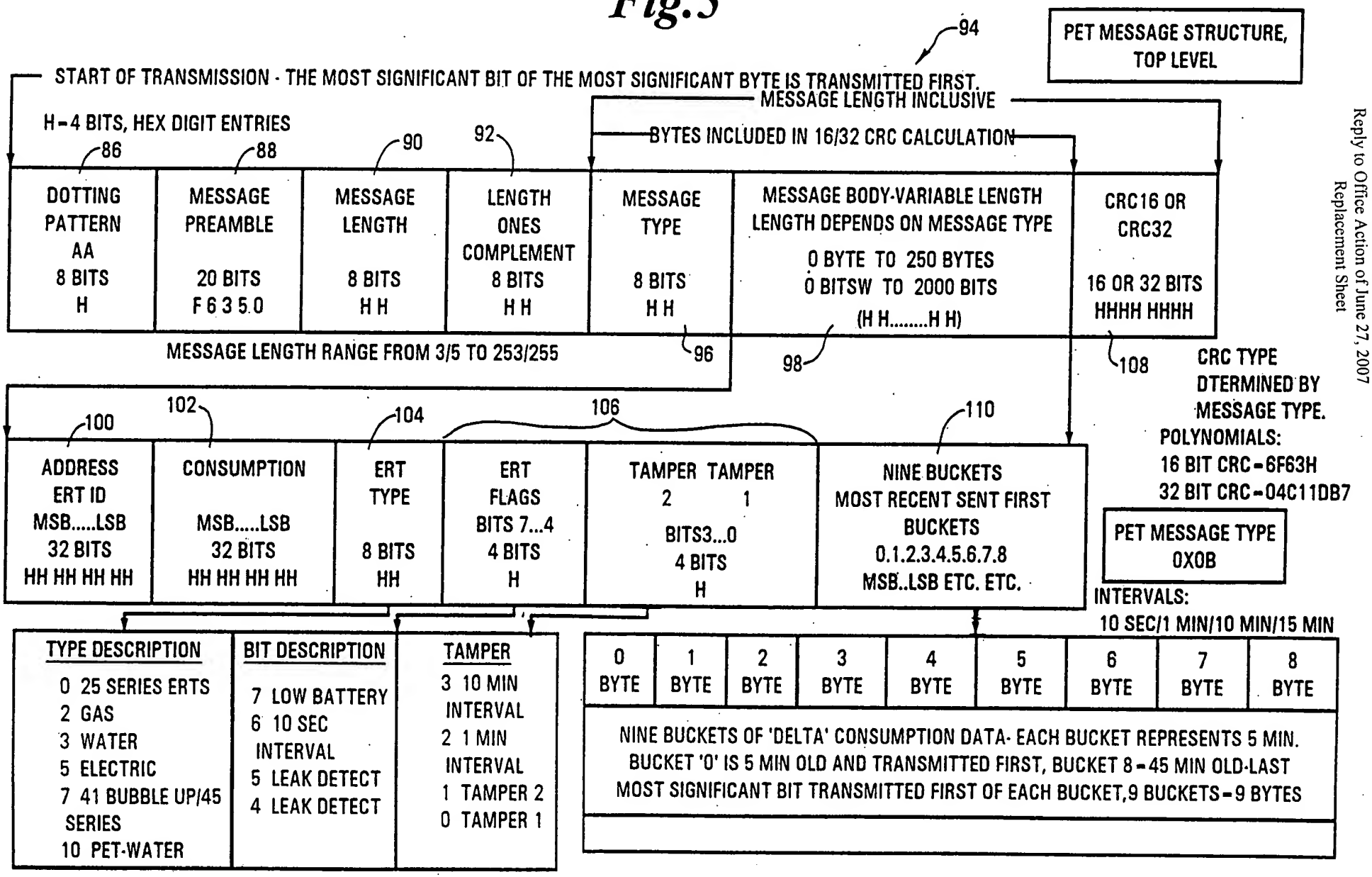
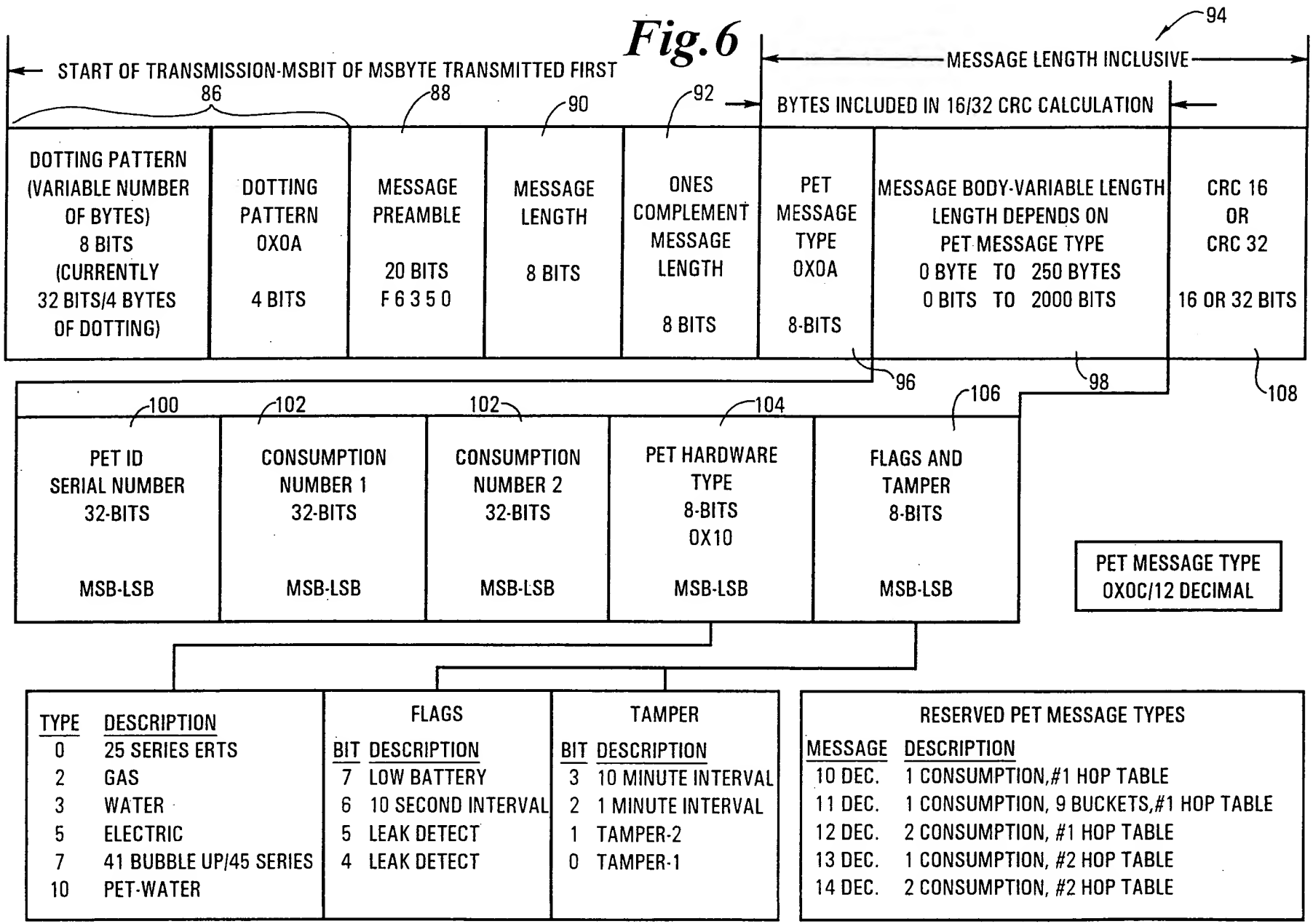

PET MESSAGE STRUCTURE, TOP LEVEL
94
START OF TRANSMISSION - THE MOST SIGNIFICANT BIT OF THE MOST SIGNIFICANT BYTE IS TRANSMITTED FIRST.
MESSAGE LENGTH INCLUSIVE
H=4 BITS, HEX DIGIT ENTRIES
BYTES INCLUDED IN 16/32 CRC CALCULATION
86
88
90
92
DOTTING PATTERN AA 8 BITS H
MESSAGE PREAMBLE 20 BITS F6350
MESSAGE LENGTH 8 BITS HH
LENGTH ONES COMPLEMENT 8 BITS HH
MESSAGE TYPE 8 BITS HH
MESSAGE BODY-VARIABLE LENGTH LENGTH DEPENDS ON MESSAGE TYPE 0 BYTE TO 250 BYTES 0 BITSW TO 2000 BITS (HH.....HH)
CRC16 OR CRC32 16 OR 32 BITS HHHH HHHH
MESSAGE LENGTH RANGE FROM 3/5 TO 253/255
96
98
108
CRC TYPE DTERMINED BY MESSAGE TYPE.
POLYNOMIALS:
16 BIT CRC=6F63H
32 BIT CRC=04C11DB7
100
102
104
106
110
ADDRESS ERT ID MSB.....LSB 32 BITS HH HH HH HH
CONSUMPTION MSB.....LSB 32 BITS HH HH HH HH
ERT TYPE 8 BITS HH
ERT FLAGS BITS 7...4 4 BITS H
TAMPER TAMPER 2 1 BITS3...0 4 BITS H
NINE BUCKETS MOST RECENT SENT FIRST BUCKETS 0.1.2.3.4.5.6.7.8 MSB..LSB ETC. ETC.
PET MESSAGE TYPE 0X0B
INTERVALS:
10 SEC/1 MIN/10 MIN/15 MIN
TYPE DESCRIPTION
0 25 SERIES ERTS
2 GAS
3 WATER
5 ELECTRIC
7 41 BUBBLE UP/45 SERIES
10 PET-WATER
BIT DESCRIPTION
7 LOW BATTERY
6 10 SEC INTERVAL
5 LEAK DETECT
4 LEAK DETECT
TAMPER
3 10 MIN INTERVAL
2 1 MIN INTERVAL
1 TAMPER 2
0 TAMPER 1
0 BYTE
1 BYTE
2 BYTE
3 BYTE
4 BYTE
5 BYTE
6 BYTE
7 BYTE
8 BYTE
NINE BUCKETS OF 'DELTA' CONSUMPTION DATA- EACH BUCKET REPRESENTS 5 MIN. BUCKET '0' IS 5 MIN OLD AND TRANSMITTED FIRST, BUCKET 8=45 MIN OLD-LAST MOST SIGNIFICANT BIT TRANSMITTED FIRST OF EACH BUCKET,9 BUCKETS=9 BYTES

Fig.6



TYPE	DESCRIPTION
0	25 SERIES ERTS
2	GAS
3	WATER
5	ELECTRIC
7	41 BUBBLE UP/45 SERIES
10	PET-WATER

FLAGS

BIT	DESCRIPTION
7	LOW BATTERY
6	10 SECOND INTERVAL
5	LEAK DETECT
4	LEAK DETECT

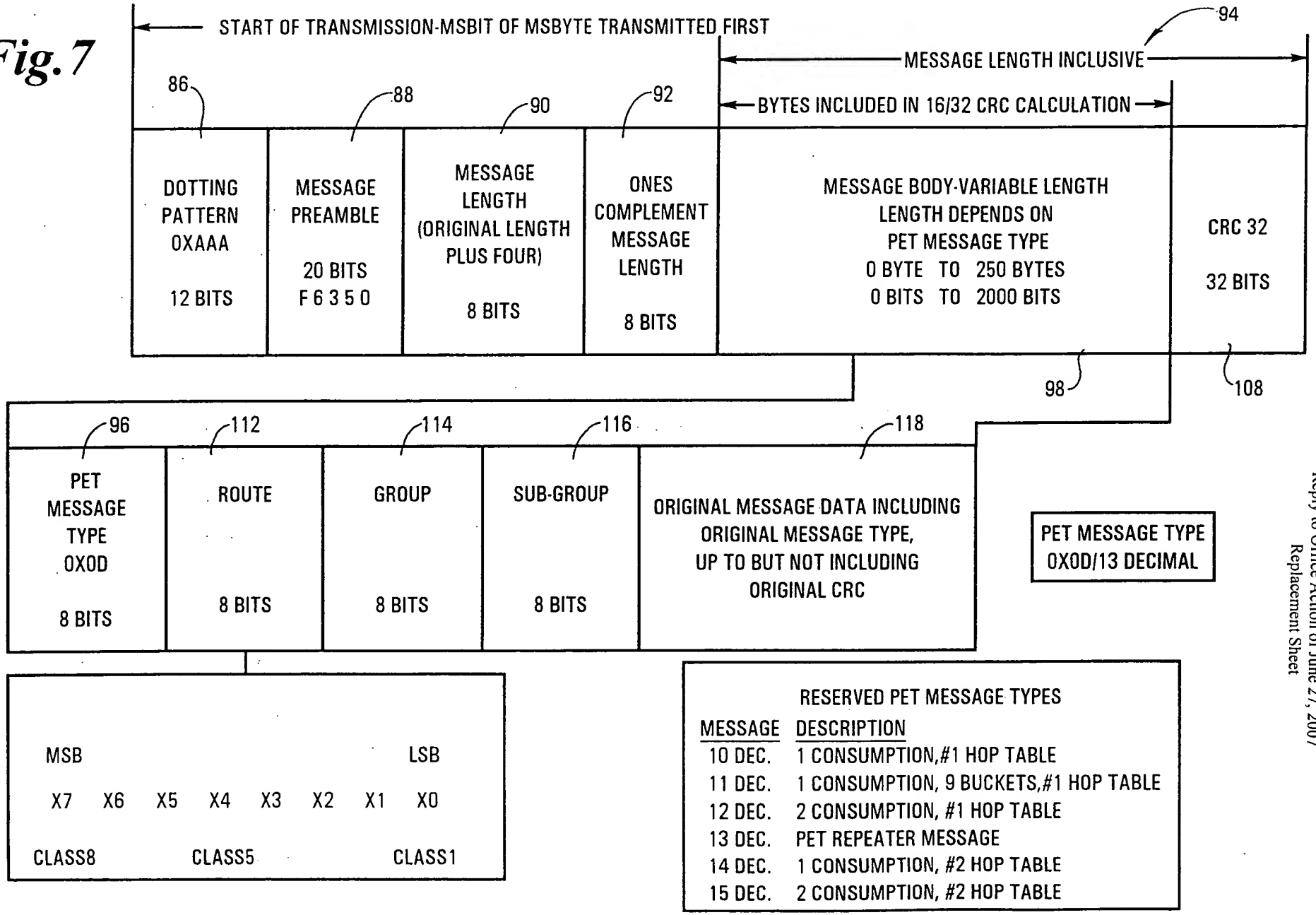
TAMPER

BIT	DESCRIPTION
3	10 MINUTE INTERVAL
2	1 MINUTE INTERVAL
1	TAMPER-2
0	TAMPER-1

RESERVED PET MESSAGE TYPES

MESSAGE	DESCRIPTION
10 DEC.	1 CONSUMPTION,#1 HOP TABLE
11 DEC.	1 CONSUMPTION, 9 BUCKETS,#1 HOP TABLE
12 DEC.	2 CONSUMPTION, #1 HOP TABLE
13 DEC.	1 CONSUMPTION, #2 HOP TABLE
14 DEC.	2 CONSUMPTION, #2 HOP TABLE

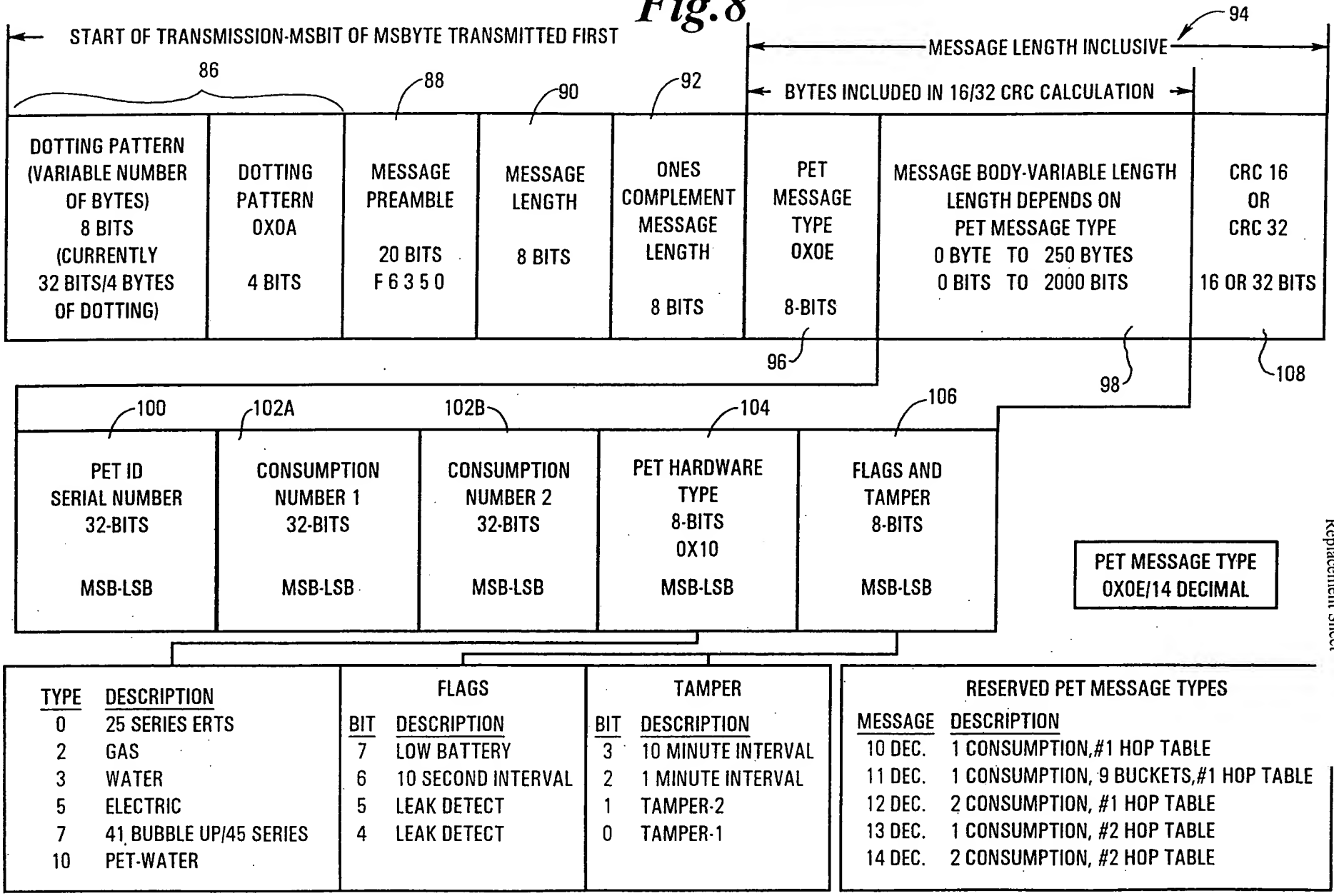
Fig. 7



RESERVED PET MESSAGE TYPES

MESSAGE	DESCRIPTION
10 DEC.	1 CONSUMPTION,#1 HOP TABLE
11 DEC.	1 CONSUMPTION, 9 BUCKETS,#1 HOP TABLE
12 DEC.	2 CONSUMPTION, #1 HOP TABLE
13 DEC.	PET REPEATER MESSAGE
14 DEC.	1 CONSUMPTION, #2 HOP TABLE
15 DEC.	2 CONSUMPTION, #2 HOP TABLE

Fig. 8



TYPE	DESCRIPTION
0	25 SERIES ERTS
2	GAS
3	WATER
5	ELECTRIC
7	41 BUBBLE UP/45 SERIES
10	PET-WATER

FLAGS

BIT	DESCRIPTION
7	LOW BATTERY
6	10 SECOND INTERVAL
5	LEAK DETECT
4	LEAK DETECT

TAMPER

BIT	DESCRIPTION
3	10 MINUTE INTERVAL
2	1 MINUTE INTERVAL
1	TAMPER-2
0	TAMPER-1

RESERVED PET MESSAGE TYPES

MESSAGE	DESCRIPTION
10 DEC.	1 CONSUMPTION,#1 HOP TABLE
11 DEC.	1 CONSUMPTION, 9 BUCKETS,#1 HOP TABLE
12 DEC.	2 CONSUMPTION, #1 HOP TABLE
13 DEC.	1 CONSUMPTION, #2 HOP TABLE
14 DEC.	2 CONSUMPTION, #2 HOP TABLE

Application No. 09/911,840
Amendment Dated August 14, 2007
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Fig.9

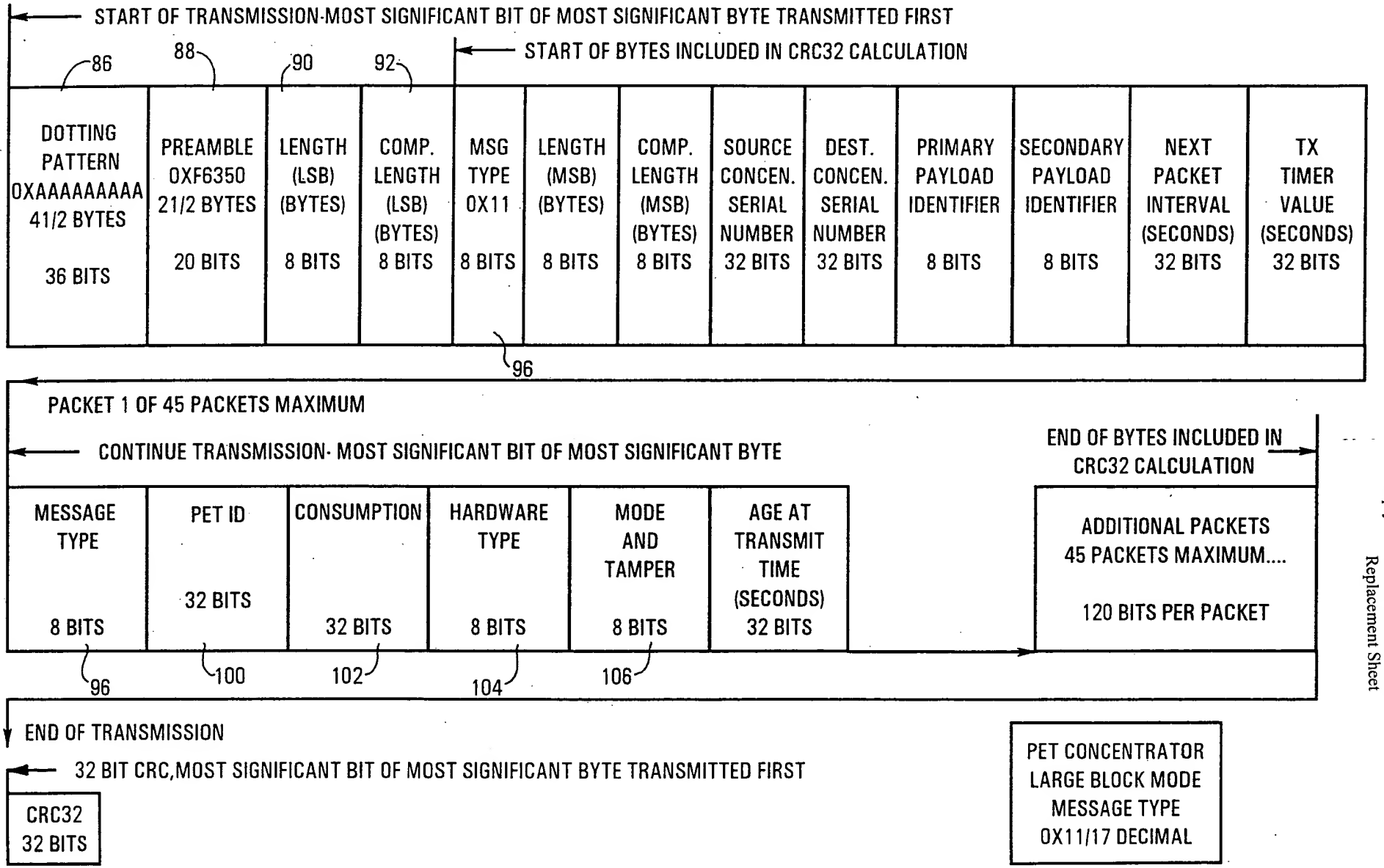

START OF TRANSMISSION-MOST SIGNIFICANT BIT OF MOST SIGNIFICANT BYTE TRANSMITTED FIRST
START OF BYTES INCLUDED IN CRC32 CALCULATION
86
88
90
92
DOTTING PATTERN 0XAAAAAAAAAA 41/2 BYTES 36 BITS
PREAMBLE 0XF6350 21/2 BYTES 20 BITS
LENGTH (LSB) (BYTES) 8 BITS
COMP. LENGTH (LSB) (BYTES) 8 BITS
MSG TYPE 0X11 8 BITS
LENGTH (MSB) (BYTES) 8 BITS
COMP. LENGTH (MSB) (BYTES) 8 BITS
SOURCE CONCEN. SERIAL NUMBER 32 BITS
DEST. CONCEN. SERIAL NUMBER 32 BITS
PRIMARY PAYLOAD IDENTIFIER 8 BITS
SECONDARY PAYLOAD IDENTIFIER 8 BITS
NEXT PACKET INTERVAL (SECONDS) 32 BITS
TX TIMER VALUE (SECONDS) 32 BITS
96
PACKET 1 OF 45 PACKETS MAXIMUM
CONTINUE TRANSMISSION- MOST SIGNIFICANT BIT OF MOST SIGNIFICANT BYTE
END OF BYTES INCLUDED IN CRC32 CALCULATION
MESSAGE TYPE 8 BITS
PET ID 32 BITS
CONSUMPTION 32 BITS
HARDWARE TYPE 8 BITS
MODE AND TAMPER 8 BITS
AGE AT TRANSMIT TIME (SECONDS) 32 BITS
ADDITIONAL PACKETS 45 PACKETS MAXIMUM.... 120 BITS PER PACKET
96
100
102
104
106
END OF TRANSMISSION
32 BIT CRC,MOST SIGNIFICANT BIT OF MOST SIGNIFICANT BYTE TRANSMITTED FIRST
CRC32 32 BITS
PET CONCENTRATOR LARGE BLOCK MODE MESSAGE TYPE 0X11/17 DECIMAL

Fig.10

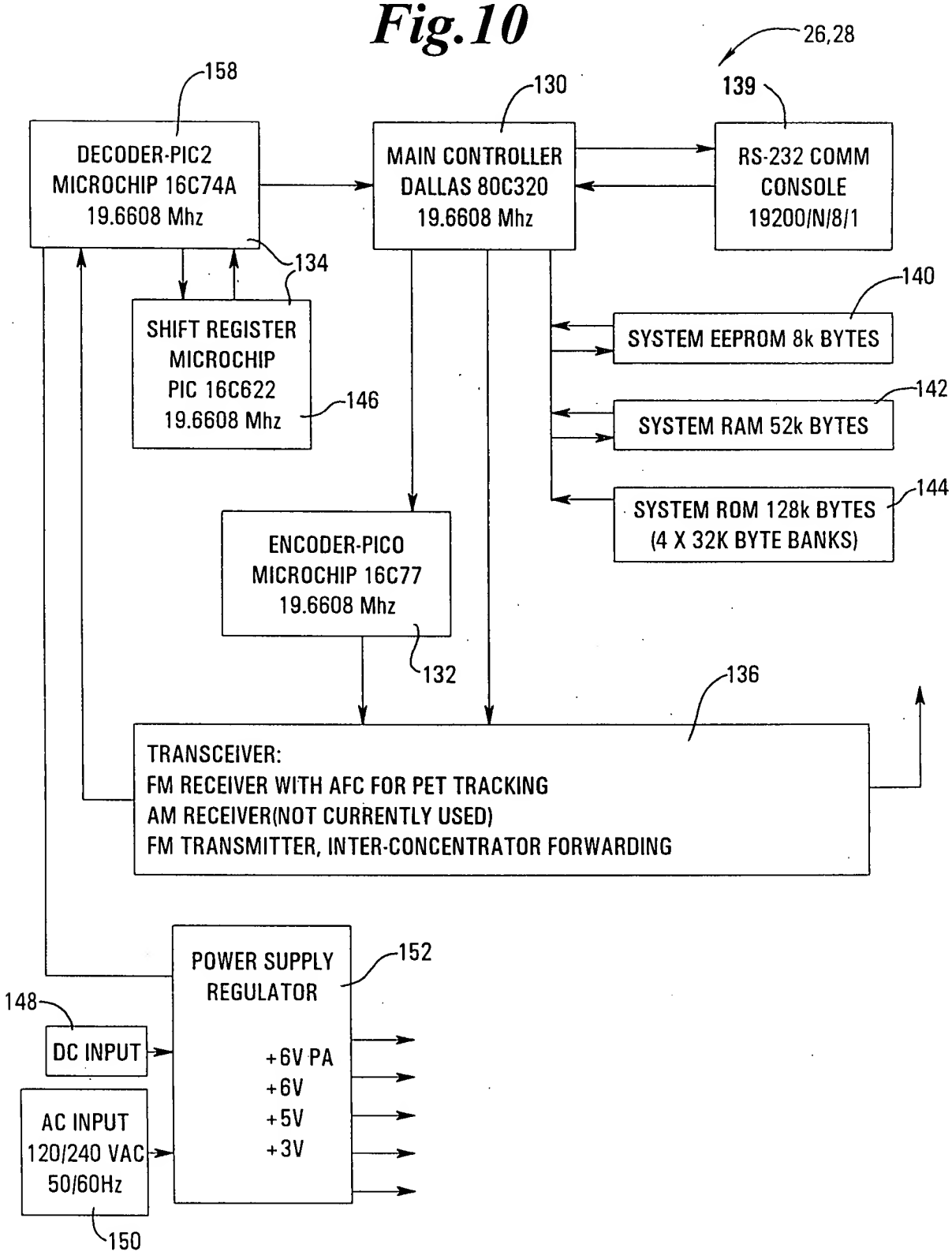

26,28
158
130
139
DECODER-PIC2
MICROCHIP 16C74A
19.6608 Mhz
MAIN CONTROLLER
DALLAS 80C320
19.6608 Mhz
RS-232 COMM
CONSOLE
19200/N/8/1
134
140
SHIFT REGISTER
MICROCHIP
PIC 16C622
19.6608 Mhz
146
SYSTEM EEPROM 8k BYTES
142
SYSTEM RAM 52k BYTES
144
SYSTEM ROM 128k BYTES
(4 X 32K BYTE BANKS)
ENCODER-PICO
MICROCHIP 16C77
19.6608 Mhz
132
136
TRANSCEIVER:
FM RECEIVER WITH AFC FOR PET TRACKING
AM RECEIVER(NOT CURRENTLY USED)
FM TRANSMITTER, INTER-CONCENTRATOR FORWARDING
POWER SUPPLY
REGULATOR
152
148
DC INPUT
+6V PA
+6V
+5V
+3V
AC INPUT
120/240 VAC
50/60Hz
150

Fig. 11

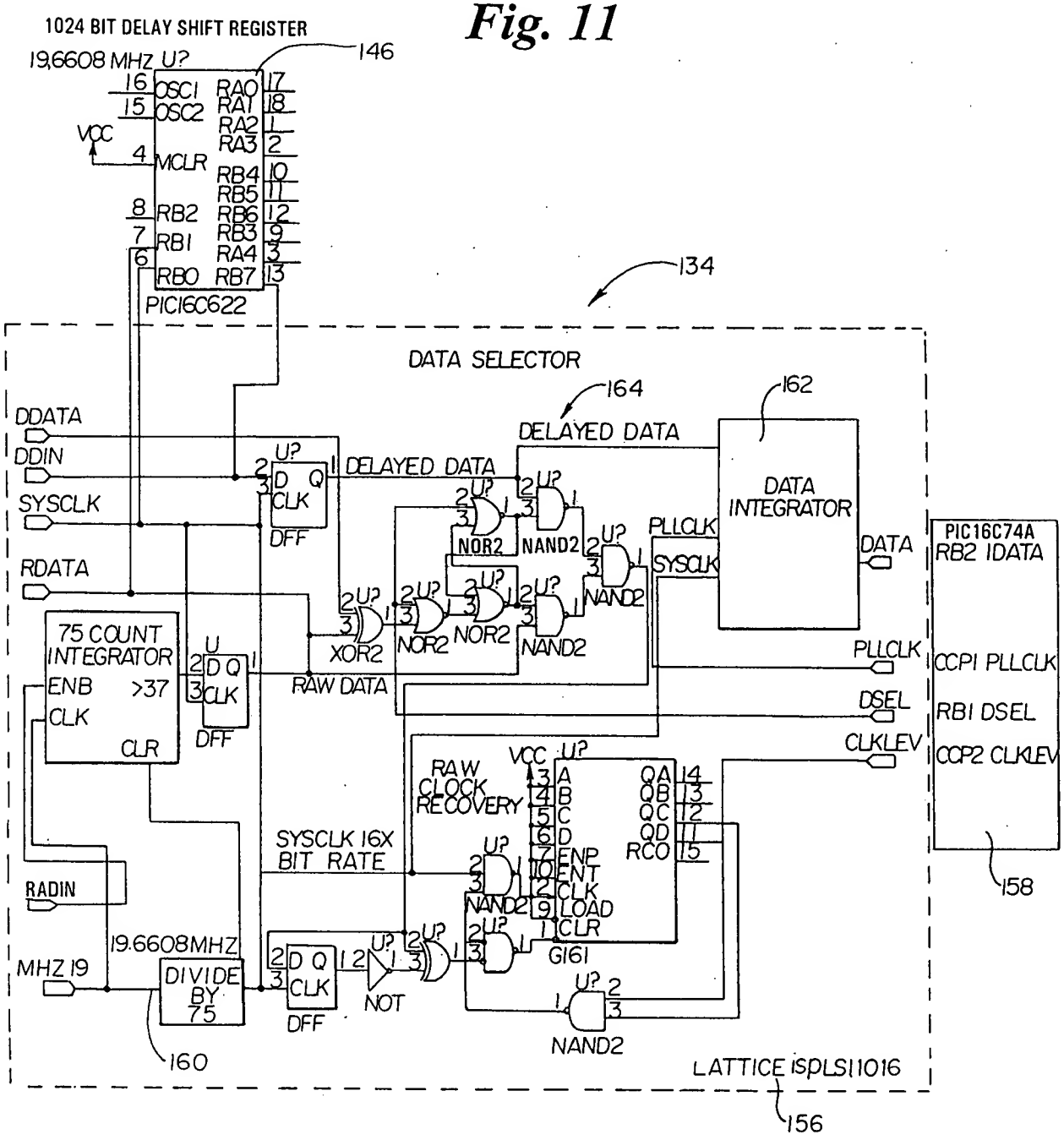

1024 BIT DELAY SHIFT REGISTER
146
19.6608 MHZ U?
OSC1
OSC2
VCC
MCLR
RB2
RB1
RB0
RA0
RA1
RA2
RA3
RB4
RB5
RB6
RB3
RA4
RB7
PIC16C622
134
DATA SELECTOR
164
DELAYED DATA
162
DATA INTEGRATOR
DDATA
DDIN
SYSCLK
RDATA
DFF
NOR2
NAND2
XOR2
PLLCLK
DATA
75 COUNT INTEGRATOR
ENB
>37
CLK
CLR
RAW DATA
RAW CLOCK RECOVERY
SYSCLK 16X BIT RATE
RADIN
19.6608MHZ
MHZ 19
DIVIDE BY 75
NOT
G161
LATTICE ISPLSI1016
156
160
PIC16C74A
RB2 IDATA
CCPI PLLCLK
RB1 DSEL
CCP2 CLKLEV
DSEL
CLKLEV
158

Fig. 12

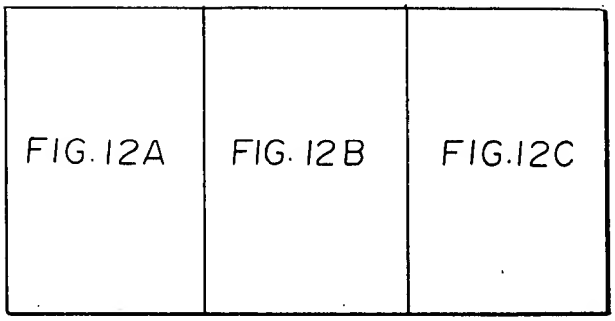


Fig.12A

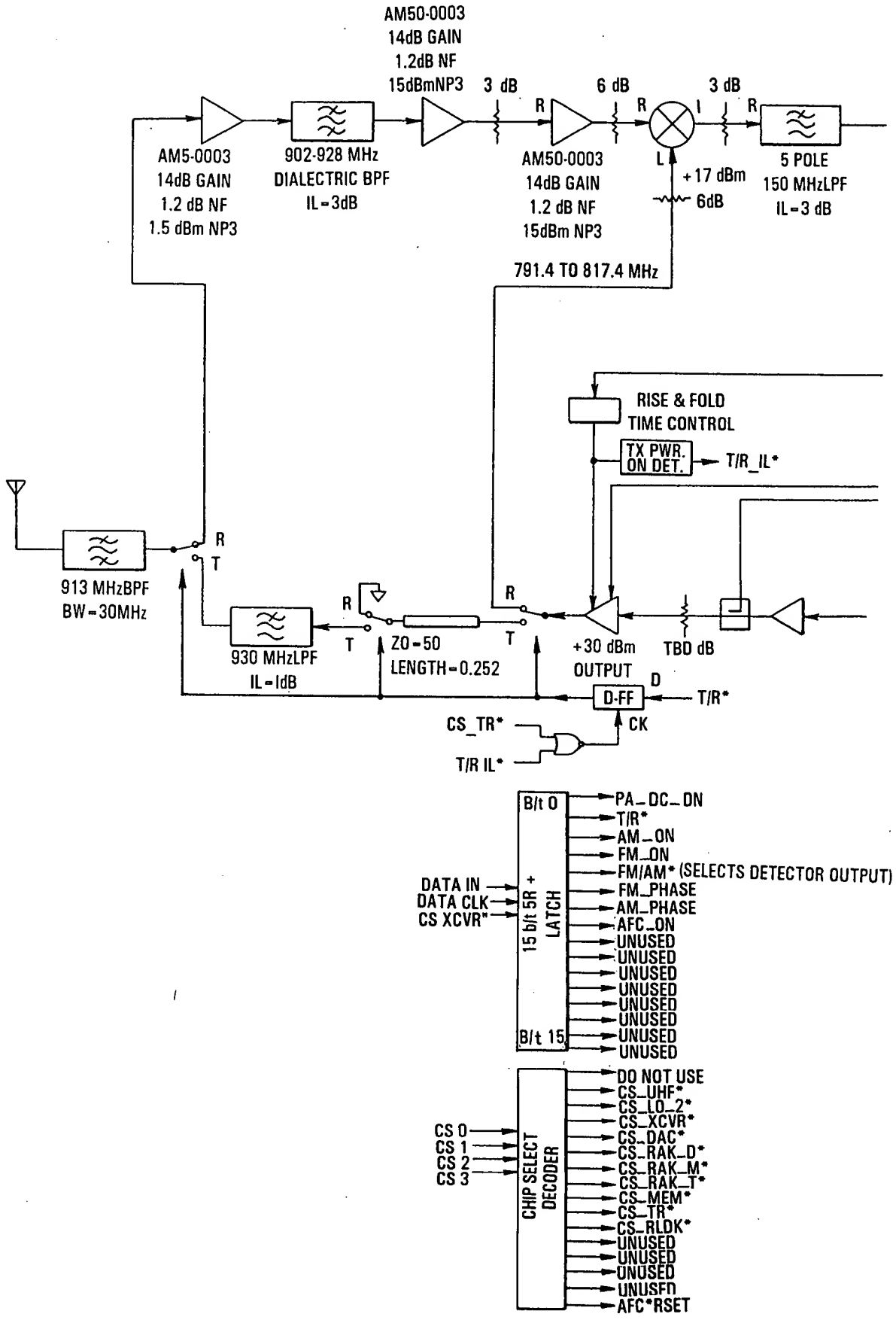

AM50-0003
14dB GAIN
1.2dB NF
15dBmNP3
3 dB
6 dB
3 dB
R
R
I
R
AM5-0003
14dB GAIN
1.2 dB NF
1.5 dBm NP3
902-928 MHz
DIALECTRIC BPF
IL=3dB
AM50-0003
14dB GAIN
1.2 dB NF
15dBm NP3
L
+17 dBm
6dB
5 POLE
150 MHzLPF
IL=3 dB
791.4 TO 817.4 MHz
RISE & FOLD
TIME CONTROL
TX PWR.
ON DET.
T/R_IL*
913 MHzBPF
BW=30MHz
R
T
930 MHzLPF
IL=1dB
R
T
Z0=50
LENGTH=0.252
T
R
+30 dBm
OUTPUT
TBD dB
D
D-FF
T/R*
CK
CS_TR*
T/R IL*
B/t 0
B/t 15
15 b/t 5R + LATCH
DATA IN
DATA CLK
CS XCVR*
PA_DC_ON
T/R*
AM_ON
FM_ON
FM/AM* (SELECTS DETECTOR OUTPUT)
FM_PHASE
AM_PHASE
AFC_ON
UNUSED
UNUSED
UNUSED
UNUSED
UNUSED
UNUSED
UNUSED
UNUSED
CHIP SELECT DECODER
CS 0
CS 1
CS 2
CS 3
DO NOT USE
CS_UHF*
CS_LO_2*
CS_XCVR*
CS_DAC*
CS_RAK_D*
CS_RAK_M*
CS_RAK_T*
CS_MEM*
CS_TR*
CS_RLDK*
UNUSED
UNUSED
UNUSED
UNUSED
AFC*RSET

Fig.12B

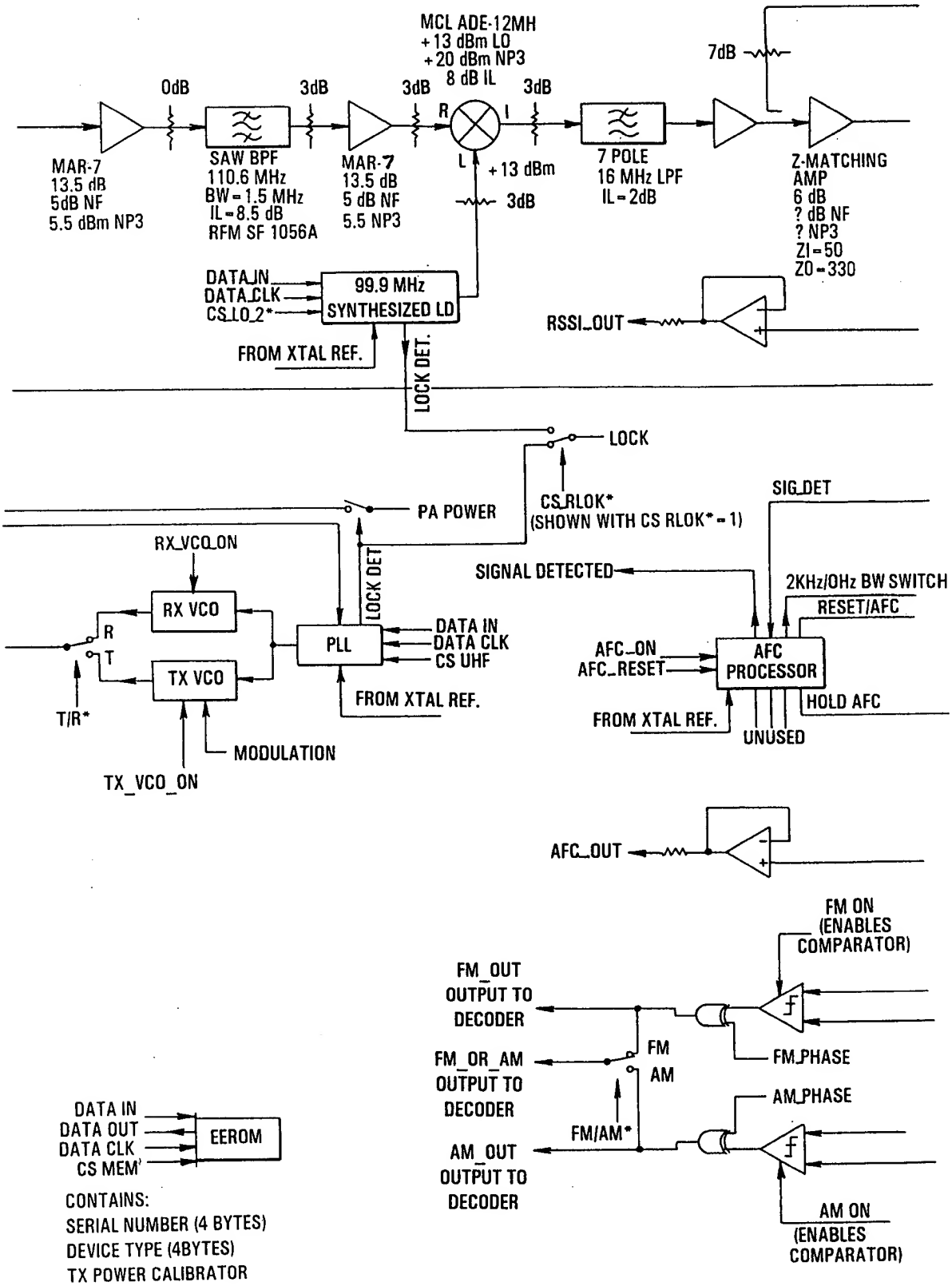

MCL ADE-12MH
+13 dBm LO
+20 dBm NP3
8 dB IL
0dB
3dB
3dB
3dB
7dB
R
I
L
MAR-7
13.5 dB
5dB NF
5.5 dBm NP3
SAW BPF
110.6 MHz
BW=1.5 MHz
IL=8.5 dB
RFM SF 1056A
MAR-7
13.5 dB
5 dB NF
5.5 NP3
+13 dBm
3dB
7 POLE
16 MHz LPF
IL=2dB
Z-MATCHING
AMP
6 dB
? dB NF
? NP3
ZI=50
ZO=330
DATA_IN
DATA_CLK
CS_LO_2*
99.9 MHz
SYNTHESIZED LD
FROM XTAL REF.
LOCK DET.
RSSI_OUT
LOCK
CS_RLOK*
(SHOWN WITH CS RLOK*=1)
PA POWER
SIG_DET
SIGNAL DETECTED
2KHz/0Hz BW SWITCH
RESET/AFC
RX_VCO_ON
LOCK DET
RX VCO
R
T
TX VCO
PLL
DATA IN
DATA CLK
CS UHF
FROM XTAL REF.
T/R*
MODULATION
TX_VCO_ON
AFC_ON
AFC_RESET
AFC
PROCESSOR
HOLD AFC
FROM XTAL REF.
UNUSED
AFC_OUT
FM ON
(ENABLES
COMPARATOR)
FM_OUT
OUTPUT TO
DECODER
FM_OR_AM
OUTPUT TO
DECODER
FM
AM
FM_PHASE
AM_PHASE
FM/AM*
AM_OUT
OUTPUT TO
DECODER
AM ON
(ENABLES
COMPARATOR)
DATA IN
DATA OUT
DATA CLK
CS MEM'
EEROM
CONTAINS:
SERIAL NUMBER (4 BYTES)
DEVICE TYPE (4BYTES)
TX POWER CALIBRATOR

Fig.12C

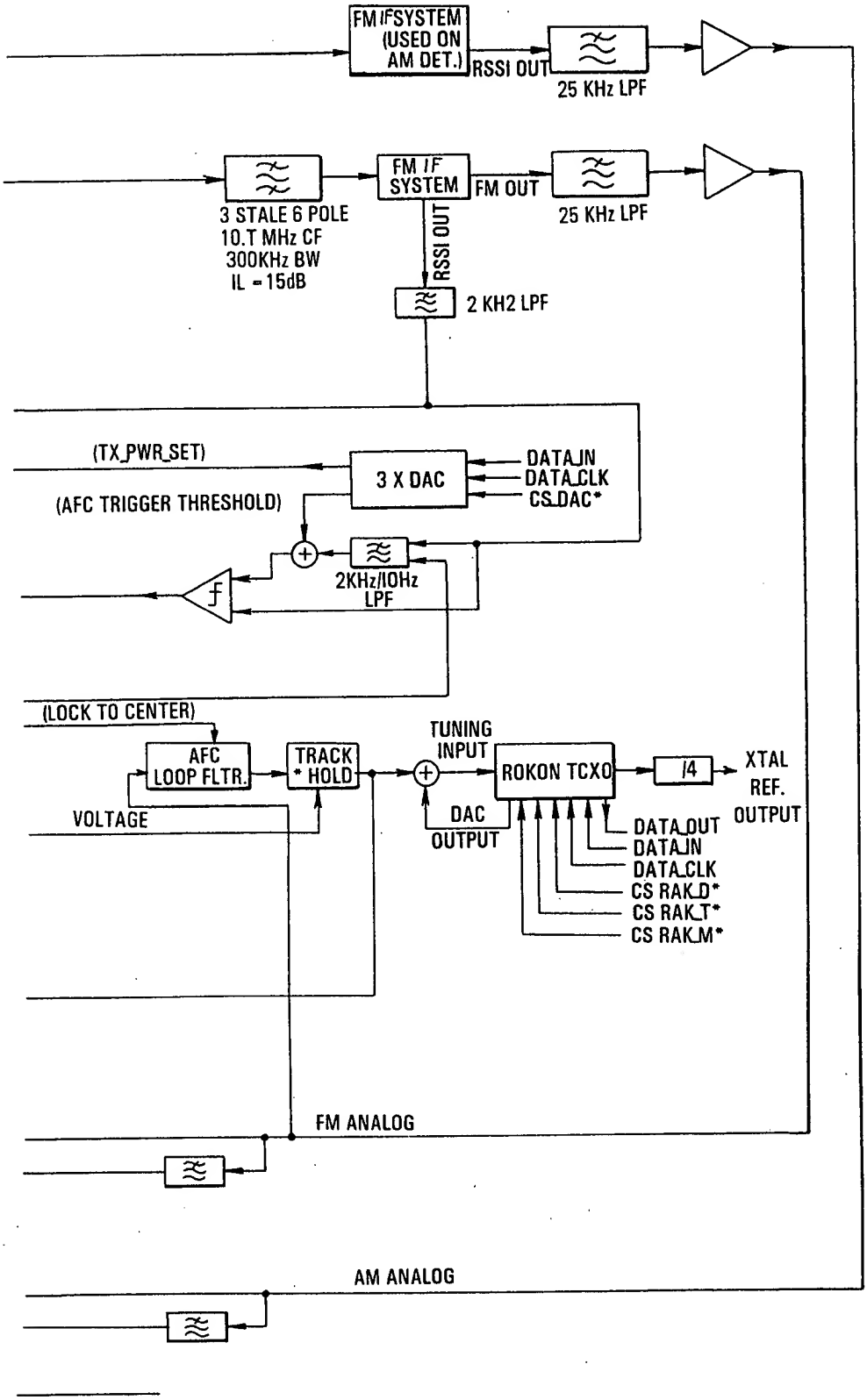
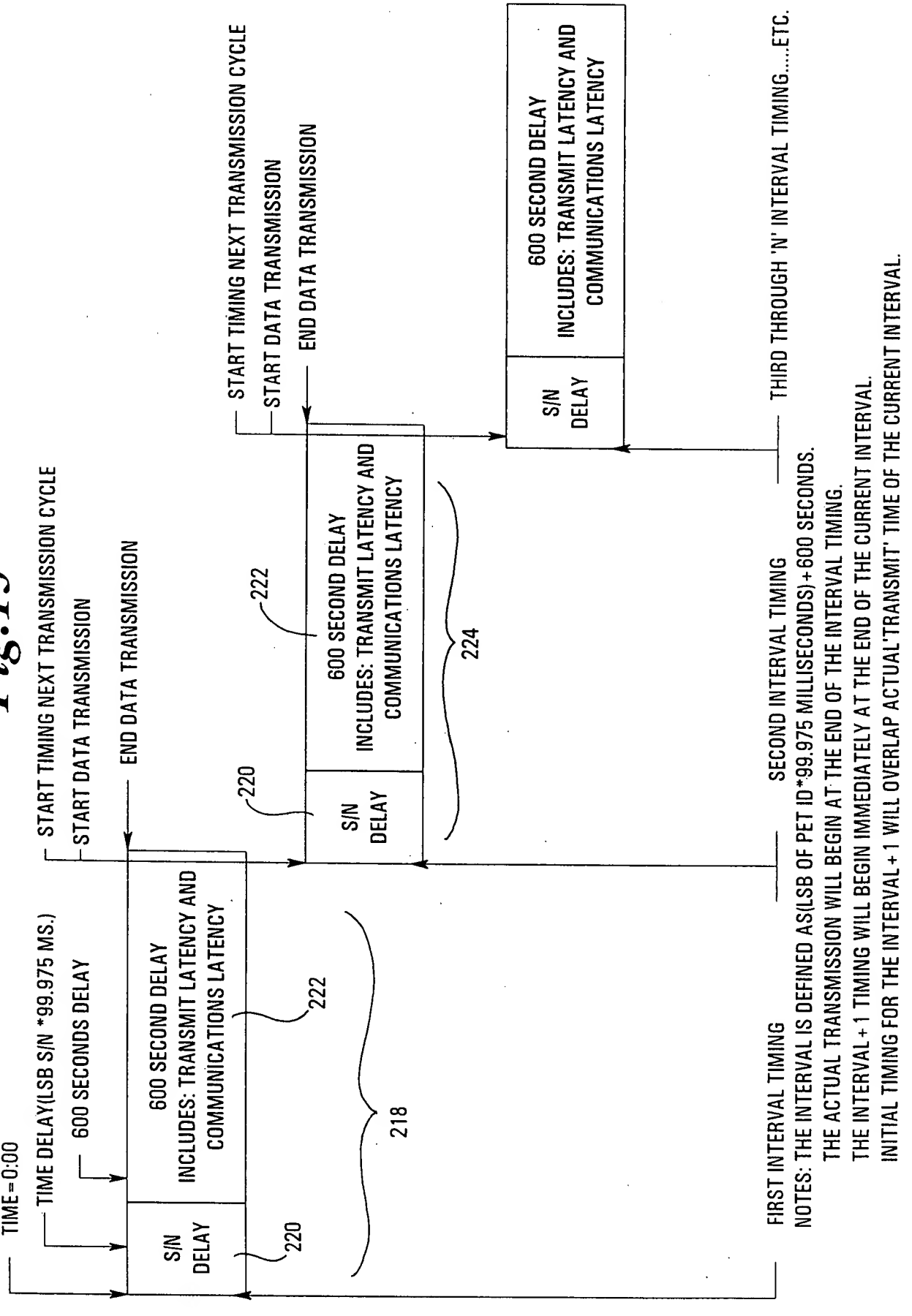

FM IF SYSTEM (USED ON AM DET.)
RSSI OUT
25 KHz LPF
3 STALE 6 POLE
10.T MHz CF
300KHz BW
IL = 15dB
FM IF SYSTEM
FM OUT
25 KHz LPF
RSSI OUT
2 KH2 LPF
(TX_PWR_SET)
(AFC TRIGGER THRESHOLD)
3 X DAC
DATA_IN
DATA_CLK
CS_DAC*
2KHz/10Hz LPF
(LOCK TO CENTER)
AFC LOOP FLTR.
TRACK * HOLD
TUNING INPUT
ROKON TCXO
/4
XTAL REF. OUTPUT
VOLTAGE
DAC OUTPUT
DATA_OUT
DATA_IN
DATA_CLK
CS RAK_D*
CS RAK_T*
CS RAK_M*
FM ANALOG
AM ANALOG

Fig. 13


TIME = 0:00
TIME DELAY(LSB S/N *99.975 MS.)
600 SECONDS DELAY
S/N DELAY
600 SECOND DELAY INCLUDES: TRANSMIT LATENCY AND COMMUNICATIONS LATENCY
START TIMING NEXT TRANSMISSION CYCLE
START DATA TRANSMISSION
END DATA TRANSMISSION
220
222
218
224
FIRST INTERVAL TIMING
SECOND INTERVAL TIMING
THIRD THROUGH 'N' INTERVAL TIMING.....ETC.
NOTES: THE INTERVAL IS DEFINED AS(LSB OF PET ID*99.975 MILLISECONDS)+600 SECONDS.
THE ACTUAL TRANSMISSION WILL BEGIN AT THE END OF THE INTERVAL TIMING.
THE INTERVAL+1 TIMING WILL BEGIN IMMEDIATELY AT THE END OF THE CURRENT INTERVAL.
INITIAL TIMING FOR THE INTERVAL+1 WILL OVERLAP ACTUAL 'TRANSMIT' TIME OF THE CURRENT INTERVAL.

PET RECEIVER MINIMUM WINDOW

NOTE: THE WINDOW REQUIRED IS 380 MILLISECONDS(200ms EARLY PLUS 180ms LATE) THIS REPRESENT THE MINIMUM TIME NECESSARY TO COMPENSATE FOR CRYSTAL TOLERANCES AND PREAMBLE DETECT.
200 MILLISECONDS REPRESENTS 180 MILLISECONDS EARLY PLUS 20 MILLISECONDS ALLOWED FOR PREAMBLE DETECT TO OCCUR.
THE INTERVAL IS MAINTAINED AND REPRESENTS THE TIME FROM ONE PREAMBLE DETECT TO THE NEXT PREAMBLE DETECT.

Fig.14

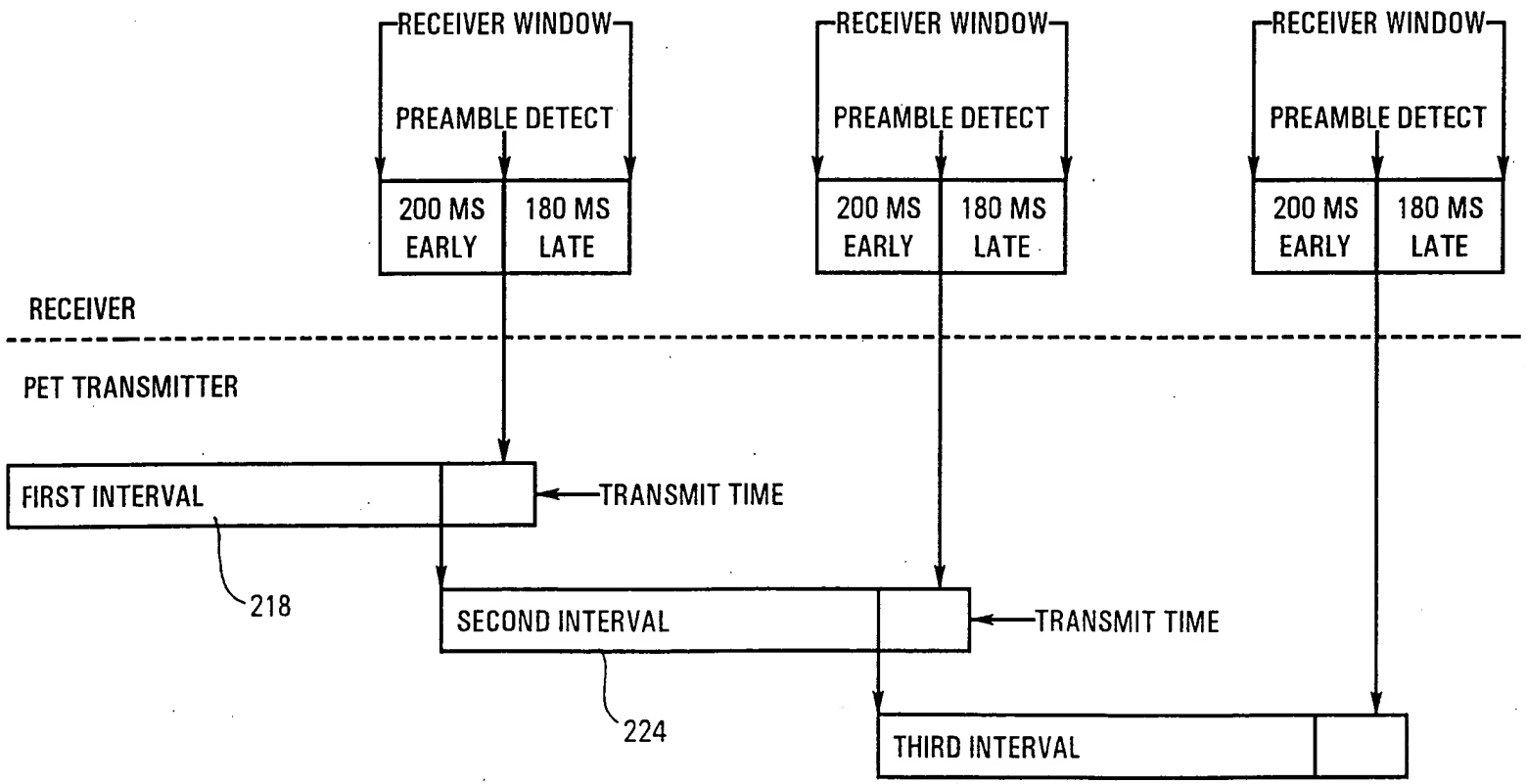
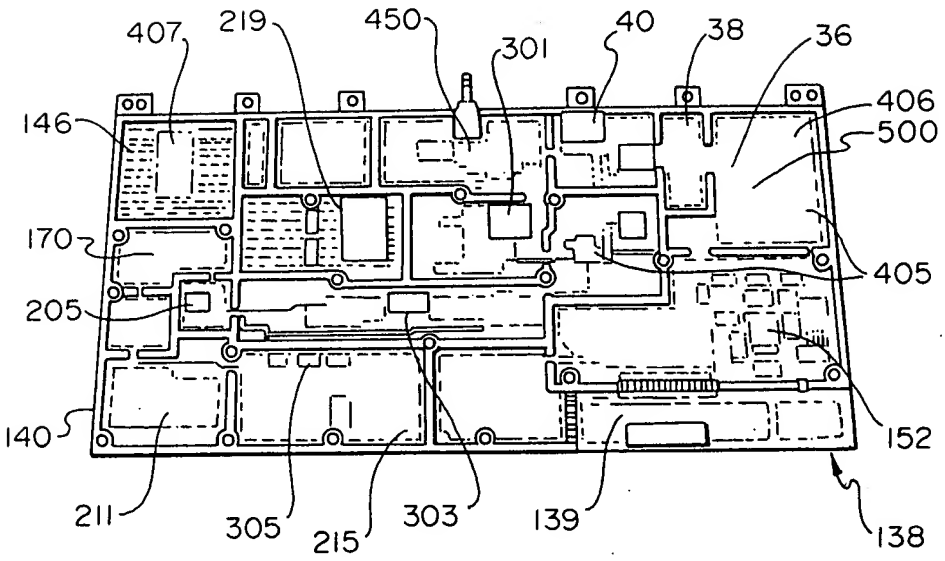


Fig. 15


407
219
450
301
40
38
36
406
500
146
170
205
405
140
152
211
305
215
303
139
138

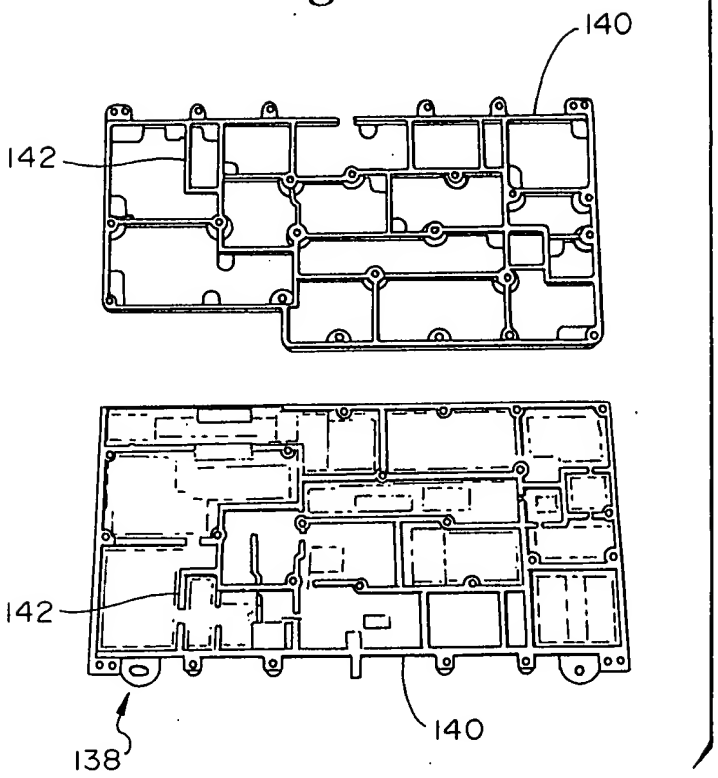



Fig. 16